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BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
IMPLEMENTATION OF SECTION 255 OF THE TELECOMMUNICATIONS ACT OF 1996	)	
	)	WT Docket No. 96-198
ACCESS TO TELECOMMUNICATIONS SERVICES, TELECOMMUNICATIONS EQUIPMENT, AND CUSTOMER PREMISES EQUIPMENT BY PERSONS WITH DISABILITIES	)	

COMMENTS OF SIEMENS BUSINESS COMMUNICATION SYSTEMS, INC.

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SUMMARY

As a manufacturer of telecommunications and customer premises equipment (CPE), Siemens has a longstanding interest in facilitating access to the telecommunications network by all of its customers and has devoted significant attention to disability access issues for many years. Among other things, Siemens has been a leading advocate for and participant in the founding of The Association of Access Engineering Specialists (AAES).

Siemens strongly supports the Commission's expressed "end goal" in this proceeding: ensuring that consumers with disabilities have access to telecommunications services and equipment. The Commission can achieve this goal best by promoting technological flexibility and encouraging research and innovation that will lead to improved access features.

The Commission should perform its own independent and thorough analysis before adopting any of the Access Board's guidelines. In particular, the Commission should not adopt Access Board guideline Section 1193.43(e) requiring telephone handsets to have volume control adjustable up to a minimum of 20 dB. The data supporting this guideline has been refuted by tests conducted by Siemens engineers, the results of which are summarized in the appendix to these Comments. The Commission, therefore, should not adopt Section 1193.43(e) -- or for that matter, any other Access Board guideline -- without conducting its own independent analysis.

To encourage innovations in access solutions, the Commission should establish a voluntary mechanism by which manufacturers can obtain pre-marketing assurance that they will not be subject to sanctions or damages for new product designs. The Commission's current proposal to determine Section 255 compliance depending entirely upon whether complaints are filed does not provide sufficient incentives for manufacturers to incorporate innovative access designs into their products.

The Commission should not use its scarce resources to evaluate whether the incorporation of any particular telecommunications accessibility feature is "readily achievable." Rather, the Commission should focus its analysis on the manufacturer's total proposed access solution, including customer sales, service and support. Indeed, Siemens supports the Commission's proposal to evaluate a product's accessibility not only in terms of the equipment itself but also of ancillary support services such as consumer information and documentation.

Siemens urges the Commission to ensure that the responsibility for the compatibility of CPE with peripheral devices and specialized CPE ("adaptive technology") is shared by both the manufacturers of CPE and the suppliers of adaptive technology. The lack of standard interfaces used by suppliers of adaptive technology stands as one of the largest impediments to achieving successful compatibility results. The Commission's staff has taken a leadership role in the efforts to achieve hearing aid compatibility with digital wireless handsets and should undertake a similar role with regard to the compatibility of adaptive technology.

The Commission long has relied on voluntary standards organizations such as American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers (IEEE) in developing its technical regulations. Siemens recommends that in implementing Section 225 the FCC similarly rely on consensus industry standards and utilize existing broad-based access engineering organizations such as AAES for advice in resolving disability access complaints.

The FCC also should define a process for international harmonization of disability access issues. The European Community already has initiated efforts to address disability access issues. Siemens recommends that the Commission develop a process by which the EC efforts and the Commission's own efforts may converge to establish parallel disability access requirements and criteria similar to the Commission's proposal in GEN Docket No. 98-68 to implement the Mutual Recognition Agreement relating to equipment authorizations.

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COMMENTS OF SIEMENS BUSINESS COMMUNICATION SYSTEMS, INC.

Siemens Business Communication Systems, Inc. (Siemens), by its attorneys, hereby files these comments in response to the Notice of Proposed Rulemaking, FCC 98-55, issued in the above-captioned docket (NPRM). Siemens appreciates this opportunity to provide the FCC with comments on the implementation of Section 255 of the Communications Act of 1934, as amended ("the Act"), 47 U.S.C. § 255.

As a manufacturer of telecommunications and customer premises equipment (CPE), Siemens has a longstanding interest in facilitating access to the telecommunications network by all of its customers and has devoted significant attention to disability access issues for many years. For example, Siemens, as co-chair, has led the way in establishing the ANSI C63.19 standard for wireless hearing aid compatibility. Meetings held in Copenhagen last month with the International Electrotechnical Commission (IEC) demonstrate the international recognition of that effort and promise to open the way for international harmonization. Siemens' continued commitment to this issue also is demonstrated through its membership on the

Telecommunications Access Advisory Committee (TAAC) to the Architectural and Transportation Barriers Compliance Board ("Access Board"), on which it held a co-chair on the compliance sub-committee. Early in the TAAC process, the Siemens Desktop Products Division voluntarily instituted a process of accessibility planning with every new product development project. This process is based upon a customization of the Electronic Industries Foundation (EIF) guidelines. As a result, Siemens has a substantial history of incorporating accessibility considerations in its products.

Subsequent to the TAAC, Siemens has been a leading advocate for and participant in the founding of The Association of Access Engineering Specialists (AAES). It is our belief that this organization holds great promise as it pursues its efforts to develop the discipline of telecommunications access and provides a neutral setting for all parties to seek common understanding of the issues involved. In all these efforts Siemens has enjoyed an active dialogue and collegial working relationship with advocates for the disabled, manufacturers of adaptive technology, regulators and researchers in related fields. This participation has given Siemens an understanding of the issues involved in ensuring that telecommunications services are accessible to and usable by persons with disabilities.

Siemens filed comments in response to the Notice of Inquiry, FCC 96-382, 11 FCC Rcd 19152 (1996), that initiated this proceeding and submitted the following recommendations:

- The Commission should adopt flexible guidelines, rather than rigid rules.
- The Commission should establish clear guidelines by which a manufacturers' compliance with Section 255 of the Communications Act would be judged.
- The Commission should rely on consensus engineering standards and should consider establishment of a joint industry-consumer advisory board.

Siemens continues to urge the Commission to follow these recommendations. These issues and others raised by the NPRM are addressed below.

I. The Commission Should Adopt Flexible Guidelines Rather than Rigid Rules

Siemens observes and applauds the very evident care which the Commission and its staff have invested in drafting the NPRM and in their continuing efforts in support of disability access. Siemens expressly endorses the objective stated by the Commission in paragraph 3 of the NPRM:

> First and foremost, we must never lose sight of the end goal, which is ensuring that consumers with disabilities have access to telecommunications services and equipment.

In Siemens' view, the Commission's end goal is best achieved by promoting technological flexibility and encouraging research and innovation that will lead to improved access features. Rigid rules should be avoided because, by their very nature, they can define only a minimum level of performance and often inhibit further innovation. Moreover, in the rapidly changing field of telecommunications, rules that are tied to specific types of technology or access features soon may become outmoded. Indeed, Siemens had opposed the Access Board's action adopting guidelines that are written in mandatory terms because such guidelines reduce rather than promote manufacturers' incentives to develop innovative access disability solutions. Contrary to the Access Board's expressed intent, the guidelines it adopted can be interpreted to be rigid rules which do not provide manufacturers sufficient flexibility to achieve disability access design solutions that are both feasible and useable.

Siemens supports the Commission's tentative conclusion (NPRM at para 30) that it has discretion regarding the use of the Access Board guidelines in developing its own comprehensive

implementation scheme under Section 255 of the Act. Siemens notes, however, that despite acknowledging its own discretion, the Commission several times states that it proposes to "adopt" the Access Board's guidelines without revision, *See*, e.g., NPRM at paras 73-75. The Commission should not "adopt" any of the Access Board's guidelines without its own independent and thorough analysis. In particular, the Commission should clarify that it does not intend to adopt any of the mandatory language of the Access Board guidelines and should confirm that manufacturers are allowed to undertake innovative access design initiatives.

II. To Encourage Innovations In Access Solutions As Well As To Provide Some Assurance of Compliance To Manufacturers, the Commission Should Establish a Voluntary Mechanism to Assess a Product's Compliance Before the Manufacturer Brings the Product to Market

Under the Commission's proposed Section 255 enforcement procedures, when a manufacturer designs a new product it should make "good faith efforts to comply with Section 255" by undertaking some or all of the self-assessment, outreach and other measures summarized in paragraph 165 of the NPRM. The Commission, however, does not propose any means by which a manufacturer can obtain pre-marketing assurance that its product actually is Section 255 compliant. The sole means by which a manufacturer can determine its compliance is the absence of complaints after the product has reached end users.

In effect, a manufacturer of CPE is forced to wait to determine if it is compliant until the product hits the market and after all the up-front design, fabrication and product distribution costs been incurred. Moreover, because new innovations typically have weaknesses, particularly in their early embodiments, manufacturers will be reluctant to introduce new access designs if they face potential sanctions under the Commission's complaint procedures. The Commission's proposed "wait and see" regulatory structure imposes a clear disincentive for manufacturers to

incorporate innovative designs and innovative access features into their products. This is counterproductive to the Commission's "end goal" of promoting greater access by consumers with disabilities to telecommunications. Without a mechanism by which manufacturers can obtain some assurance that they will not be subject to sanctions or damages for new product designs, therefore, they will be discouraged from using any significant variations from the access methods of the past.

Siemens recommends that the Commission establish a mechanism by which a manufacturer voluntarily may obtain a pre-marketing assessment of a new product's compliance by submitting to the Commission (or a designated body with disability access expertise) the manufacturer's product specifications and company access support processes, Product designers require clear and objective specifications in order to design access features into new products, and these specifications could be submitted for pre-marketing evaluation. Similarly, documentation of company procedures can be submitted for evaluation to assure that new products are delivered to customers with the sales, service and support required for the products' effective use. A manufacturer should be allowed on a voluntary basis to submit these product specifications and company processes for compliance assessment before the product is brought to market. Although the Commission may not be able to provide a manufacturer a binding certification that compliance has been attained, the Commission at least should be able to provide the manufacturer with assurance that it will not be subject to penalties and enforcement actions for new innovative access designs that have passed voluntary pre-marketing review. The establishment of such a voluntary pre-marketing program may provide manufacturers with the incentive to develop and implement new and innovative access specifications. Moreover, the information voluntarily provided to the Commission ultimately will help the Commission build a

body of knowledge that will assist it in formulating standards to evaluate Section 255 compliance.

III. The "Readily Achievable" Assessment Should Be Based Not On Whether Specific Product "Features" Are Incorporated, But On The Effectiveness of The Proposed Solution For Delivering Access

The Commission proposes to establish a three-part standard for determining whether a particular telecommunications accessibility feature is "readily achievable." NPRM at para. 100. Siemens urges the Commission to reconsider the underlying premise of its proposal. The Commission should not be using its scarce resources to evaluate whether the incorporation of any particular telecommunications accessibility feature is "readily achievable," but should focus its analysis on the manufacturer's total proposed access solution.

By calling attention to specific access features in isolation from a manufacturer's overall system for accessibility, the Commission may lead both manufacturers and end users down the wrong path. For example, a manufacturer may design a product that incorporates a number of features deemed by the Commission to be "readily achievable," but the product may remain inaccessible because customer sales, service and support functions are lacking. Alternatively, a manufacturer may concentrate on incorporating into a single piece of equipment so many isolated features that have been designated "readily achievable" by the Commission that the manufacturer fails to ensure that the numerous features compatibly may be used together by individuals with disabilities.

Similarly, end users inappropriately may focus on whether a product has a specific feature that the Commission found "readily achievable" in another context. The more suitable question for an end user is not why a product lacks a specific feature but how is the product

designed to be used by individuals with certain disabilities. Indeed, the Commission should return a complaint which is based primarily on the absence of a specified product feature and ask the complainant to clarify whether there is a lack of accessibility taking into account the entirety of the manufacturer's system.

For example, an appropriate assessment would take a "system approach" like the following:

- What set of features and processes would be required to deliver the desired access?
- Would the system proposed in fact have the desired access?
- Is the desired access feasible?
- What would be the expense of providing the desired access?
- Given its expense, is the desired access practical?

The system approach described above immediately leads to the question of effectiveness, which the "feature" approach does not necessarily do. Using the access functions summarized in para. 74 of the NPRM, an evaluation can be made of what combination of functions and processes are required to make a product accessible to individuals with certain disabilities. Such a "system approach" is more likely than the proposed "feature approach" to produce both a set of features and a process that results in end user products that are accessible.

IV. In Evaluating A Product's Accessibility, The Commission Should Weigh The Manufacturer's Customer Support Equally With The Product Features

Siemens supports the Commission's proposal, NPRM at para. 75, that the evaluation of whether a provider has satisfied its accessibility obligations should include "not only use of the equipment itself but also support services (such as consumer information and documentation)."

The Commission's proposal to weigh support services equally with product features in its evaluation is consistent with the "system approach" recommended by Siemens in the preceding section. Siemens has learned from its dialogue with representatives of individuals with disabilities that historically many problems of accessibility arise not from the lack of product features but rather from deficiencies in the sales, service or support of the product.

For that reason, Siemens recommends that improvements in product delivery, education and customer support be counted equally with the addition of product features in assessing accessibility and what is readily achievable. A focus on all the components of a product system, including all forms of customer support, rather than just on isolated product features will better promote the Commission's end goal of increased accessibility.

V. Responsibility For Ensuring The Compatibility of CPE With Adaptive Technology Must Be Shared By All Involved Parties

The obligation to make telecommunications services and equipment compatible with adaptive technology is established under Section 255(d):

> Whenever the requirements [concerning the accessibility of (b) telecommunications equipment and CPE and (c) services] are not readily achievable, such a manufacturer or provider shall ensure that the equipment or service is compatible with existing peripheral devices or specialized customer premises equipment commonly used by individuals with disabilities to achieve access, if readily achievable. (Emphasis supplied).

Manufacturers' responsibilities under Section 255 (d) can be narrowly construed to require compatibility only with peripheral devices and specialized customer premises equipment (collectively, "adaptive devices") that are both "existing" as of the date of the statute's enactment (February 8, 1996) and that are "commonly used." Under this reading of the statute, the responsibility for compatibility arguably may fall solely on the manufacturers of

telecommunications equipment and CPE and not on the supplier of adaptive devices, but the manufacturers are not responsible for compatibility with any post- 1996 adaptive technology or any pre-existing adaptive technology that is not commonly used. Unless the statute is implemented properly, a vicious circle can emerge whereby advancements in adaptive technology are not incorporated into products because the suppliers of existing adaptive technology do not utilize standard interfaces and their technology never becomes "commonly used" so as to trigger the CPE manufacturers' obligations under Section 255(d).

In response to this potential scenario, Siemens supports the Commission's tentative conclusion, NPRM at para. 92, that this is an area where the establishment of cooperative processes (such as negotiated rulemakings) involving all interested entities, including industry and consumer groups, CPE manufacturers, telecommunication service providers and regulators, would prove useful. For example, Siemens has been extensively involved in the efforts to achieve hearing aid compatibility with digital wireless handsets. Most participants find that this effort, while not yet complete, has been very successful in identifying the relevant issues and establishing cooperative efforts to resolve them. This success is due in large part to the Commission's own effort of convening a "summit hearing" in which representatives of all interested sectors voluntarily participated. Indeed, the Hearing Industry Association and its member companies have been full partners with the wireless handset manufacturers through the standard setting process. This partnership and the cooperation it has engendered is critical to the efforts to achieve an effective hearing aid compatibility solution for wireless handsets.

The leadership the Commission exhibited in bringing the hearing aid and wireless handset industries together should be brought to bear on the Section 255 compatibility issue also. Otherwise, CPE manufacturers and suppliers of adaptive devices could become adversaries

rather than partners with a common goal. Here again, Siemens advocates a "system approach" rather than focusing on specific compatibility features. For example, a requirement to incorporate specified compatibility features in telecommunications equipment will bring negligible benefits to consumers with disabilities if there is no corresponding commitment from the suppliers of adaptive technology to utilize those features. Indeed, the lack of standard interfaces used by suppliers of adaptive technology stands as one of the largest impediments to achieving successful compatibility results. Placing the burden solely on manufacturers of telecommunications and CPE to incorporate into their products all interfaces that potentially may be designed by suppliers of adaptive technology is neither realistic nor reasonable. Siemens urges the Commission once again to take a leadership role in bringing together manufacturers of CPE, suppliers of adaptive technology, and individuals with disabilities to achieve consensus solutions.

VI. Siemens Supports the Use of Organizations such as AAES In Developing Broad Based Understanding and Commonly Held Expectations Among All Parties As Well As In Providing the Commission Non-Binding Guidance In Complaint Proceedings

The Commission long has relied on voluntary standards organizations such as American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers (IEEE) in developing its technical regulations. The Commission also has made use of the expertise of outside groups in evaluating questions related to assessment of compliance, such as the ANSI C63 sub-committee which advises, when requested, on how testing for Part 15 compliance should be conducted. Siemens recommends that in implementing Section 255 the FCC similarly rely on consensus industry standards and utilize existing broad-baaed access engineering organizations for advice in resolving disability access complaints.

One consensus-building organization the Commission should consider working with is the Association of Access Engineering Specialists (AAES). AAES was founded to foster the continuing development of the field of telecommunications access, promote related education and outreach efforts, and encourage dialogue among all affected parties with the purpose of constructing consensus solutions to access issues.

The concept for AAES was developed during the deliberations of the Telecommunications Access Advisory Committee (TAAC), which was convened by the Access Board. A number of the participants felt that there was a need to establish a neutral coordination point, where all affected parties could meet and develop the field of telecommunications access. Because many disciplines, interests and viewpoints must be involved if disability access to telecommunications is to be effectively developed, AAES is actively exploring ways in which it can effectively partner with all involved organizations. AAES is filing separate comments in which it will describe its history, organization and mission.

Siemens recommends that the Commission utilize the expertise of inclusive organizations such as AAES in resolving Section 255 complaints. Siemens supports adoption of a process by which the Commission will refer consumer inquiries and complaints for informal resolution to the manufacturer or service provider concerned. If the Commission provides the manufacturer a reasonable period of 30-60 days to engage in a dialogue with the consumer, many access complaints will be able to be resolved amicably on an informal basis without significant expenditure of Commission resources. For complaints not resolved informally through direct contact between the manufacturer and the end user, the Commission should consider granting itself the discretion to seek counsel from broad-based organizations such as AAES. Although such advice would not be binding upon the Commission, the advice could help provide benchmarks by which the Commission better may judge the manufacturer's compliance with

Section 255. Siemens urges that the Commission explore this and other means to avoid the delays and expenses associated with the Commission's traditional formal complaint process. Siemens recommends, therefore, that the Commission supplement its proposed informal complaint resolution process with other means such as referrals to expert organizations for informal guidance to aid in its resolution of the access problems of individuals.

VII. The FCC Should Define a Process for International Harmonization of Disability Access Issues

Siemens recommends that the Commission establish in this proceeding clear mechanisms by which the disability access requirements of Section 255 will be harmonized with those of other countries and international trading areas. The Commission already has initiated a separate rulemaking[1/] in which it proposes to implement the Mutual Recognition Agreement ("MRA") between the United States and the European Community that is intended to harmonize the testing and certification procedures for telecommunications products and electronic equipment between the US. and the EC in order to promote bilateral market access and competition. The Commission should establish a parallel process by which the requirements of Section 255 will be harmonized with the requirements of the MRA so that Section 225 requirements do not effectively constitute a trade barrier that isolates the U.S. market for telecommunications products from those of its international trading partners.

Indeed, substantial parallel efforts toward harmonization already are under way in Europe, as documented in the recent report from the Technical Regulations Applications Committee (TRAC) ad hoc group on Telecom for People with Special Needs (TPSN),

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1/ 1998 Biennial Regulatory Review -- Amendment of Parts 2, 25 and 68, GEN Docket No. 98-68, FCC 98-92, May 18, 1998.

(Reference TRAC/29/09). The report notes that in May 1997 the European Commission released a final draft of a proposal for a European Parliament and Council Directive on the approximation of the laws of the Member States concerning connected telecommunications equipment and the mutual recognition of the conformity of the equipment. This draft directive, also known as the CTE Directive, will replace the current directives for terminal equipment (91/263/EEC) and for satellite earth stations (93/97/EEC).

'Recital fourteen' of the draft directive states that telecommunications is important to the well being and employment of people with disabilities who are substantial and growing proportion of the population of Europe. Moreover, the Explanatory Memorandum for the draft CTE Directive expressly recognizes that there is an international trend to extend requirements in the area of features for users with disabilities and that the requirements should call for a proportionate range of features according to the type of equipment and the needs of different disability groups."

Because the EC clearly shares similar concerns for disability access issues and has parallel efforts underway to address these issues, Siemens recommends that the Commission develop a process by which the EC efforts will converge with the Commission's own efforts to establish parallel disability access criteria and requirements.

2/ According to Art. 3 of the draft, the essential requirements are divided into general essential requirements (Art. 3(1)) and specific essential requirements (Art. 3(2)). The general essential requirements are applicable to all CTE types and consist of requirements contained in the LVD and EMC Directive. The specific essential requirements applicable to each type of CTE may be selected from the list given in Art. 3(2). According to Art. 4(1), the Commission shall identify the specific essential requirements; and in selecting the applicable essential requirements, the Commission shall give, where justified, due consideration to, among other issues, features for users with disabilities.

VIII. The Commission Should Not Adopt The Access Board's Guideline For Telephone Handset Volume Control

As discussed in Section I above, the Commission should not adopt any of the Access Board's guidelines without its own independent and thorough analysis. One Access Board guideline in particular that the Commission should not adopt without independent analysis is Section 1193.43(e), 36 C.F.R. § 1193.43(e), concerning volume control of telephone handsets. That Section reads as follows:

> Section 1193.43. All information necessary to operate and use the product, including but not limited to, text, static or dynamic images, icons, labels, sounds, or incidental operating cues, shall comply with each of the following, assessed independently:
>
> * * *
>
> (e) AVAILABILITY OF AUDITORY INFORMATION FOR PEOPLE WHO ARE HARD OF HEARING. Provide audio or acoustic information, including any auditory feedback tones that are important for the use of the product, through at least one mode in enhanced auditory fashion (i.e., increased amplification, increased signal-to-noise ratio, or combination). For transmitted voice signals, provide a gain adjustable up to a minimum of 20 dB. For incremental volume control, provide at least one intermediate step of 12 dB of gain.

This Access Board guideline for volume control with a minimum gain of 20 dB is based on faulty technical premises. The Access Board accepted, without adequate analysis, information submitted to it based upon a very narrow product sampling of three telephone handsets. The derivation of general conclusions for all telecommunications products from a test of only three handsets is exceedingly perilous.

The Access Board's guideline conflicts with the telephone industry consensus that a 20 dB gain is not readily achievable without special circuitry. Siemens' engineers tested the three telephone handset models used in the tests cited in the Access Board's commentary (63 Fed. Reg.

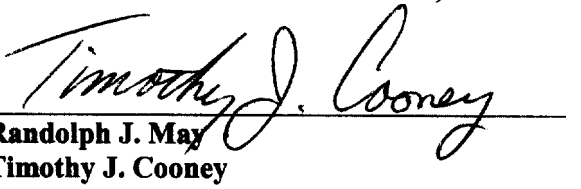
5621-22 (February 3, 1998)), and found that extending the mandatory volume control range to 20 dB or 25 dB could not be justified based on the test results from these three handsets. Siemens engineers found that two of the telephones became unstable ("squealed") when the handset was placed face down on a desktop or when placed on its cradle. The third telephone, the one not subject to such feedback, employed DSP circuitry not found in a typical telephone, had a noise problem, and did not have 20 dB gain. The three telephones tested also had other characteristics that indicate that they should not be the standard for general use telephones. These characteristics, the evaluation criteria for the Siemens' tests, and the test results themselves are summarized in the Appendix to these comments. Because the data show the underlying Access Boards volume control guideline is at best questionable, the Commission should not adopt Section 1193.43(e) without its own independent analysis.

IX. CONCLUSION

For the foregoing reasons, Siemens urges the Commission to take actions consistent with the recommendations expressed above.

Respectfully submitted,

SIEMENS BUSINESS COMMUNICATION SYSTEMS, INC.



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June 30, 1998

APPENDIX

Siemens Business Communicaion Systems, Inc.

WT Docket No. 96-198

June 30, 1998

TIA4 1.3/98-

CONTRIBUTION TO TR-41.3

Norfolk, VA.

INDEX

INTRODUCTION:

The *Telecommunications Act Accessibility Guidelines,* Section *1193.43* paragraph (e) states that *".. the proposed gain of 25 dB is not a problem for current telephone technology."* and that *"High gain phones without special circuitry currently on the market were tested which put out 90 dB and 105 dB at maximum volume setting. This is a 20 dB gain over the standard* 85 *dB"* This is in conflict with telephone industry assertions that such a range is not easily achievable without special circuitry.

The complete text of section 1193.43 (e) is attached as Annex A of this report. Also attached as Annex B is the relevant section of the FCC Notice of Proposed Rulemaking released April 20, 1998.

The same three manufacturer's telephone models used as proof-of-achievable in the Access Board guidelines were purchased and tested. The volume controls were tested as well as other related parameters important for safe and reliable operation. The samples are designated Sample "A", Sample "B" and Sample "C" in this report.

Both Sound Pressure Level **(SPL)** at 1 kHz and Receive Objective Loudness Ratings **(ROLR)** were used to determine the volume control range. A discussion of both methods is on page 12.

CONCLUSIONS:

Refer to EVALUATION CRITERIA (page 3) and TEST RESULTS (pages 4-7) for detailed results.

1. Extending the mandatory volume control range to 20 dB or 25 dB should not be justified using these three telephones as a rational.

2. Stability (feedback) is a problem with increased volume. Two of the telephones became unstable ("squealed") when the handset was placed face down on a desktop, or when replacing it on cradle. One unit occasionally became unstable when bringing the handset near the head. The one telephone that did not feedback employed DSP circuitry not found in a typical telephone, had a noise problem and did not have 20 dB gain.

   Stability becomes a bigger problem when manufacturing tolerances are considered. The samples tested had less than nominal transmit level. TIA-470B tolerances allow a 5 dB higher than nominal send level which would directly take away from the stability margin.

3. None of the telephones had a 25 dB volume control range. One telephone had a 23 dB range but started out 6 dB quieter than the specification for a nominal telephone.

4. Two of the telephones require wall-warts (ac supplies) which may be acceptable for a specialized telephone but not for general use telephones.

5. Either Loudness **(ROLR)** or Sound Pressure Level **(SPL)** at 1 kHz may be used to measure the volume control range as long as the shape of the frequency response curve remains constant over the range. If the shape of the frequency response curve changes then ROLR is a more accurate indicator.

   SPL level at 1 kHz is not a good indicator of absolute loudness, however, since it does not account for the frequency response of the handset (i.e., the receiver could have a peak or dip at 1 kHz). In addition, the input circuit and voltage must be specified for the SPL measurement to be usable.

These telephones no doubt are useful to the hearing impaired but should not be the standard for general use telephones.

DESCRIPTION OF TELEPHONES TESTED:

All three models tested were designed specifically for the hearing-impaired. All models had extra large keys. All had memory dialing. None had speakerphones.

SAMPLE "A"

- This model uses a slide-potentiometer volume control.
- A "Tone" control allows the frequency response of the received voice to be changed. Testing was done using the middle position of this control.
- There is also an "Outgoing Voice Volume" switch -the instruction book states that when activated the transmit level is increased by 15 dB.

SAMPLE "B"

- This design uses a 4 band Graphic Equalizer for a volume control. The bands are centered on 600,1200,1800 and 2400 Hz. Each band has a labeled gain range of 0 to +20 dB.
- An "EQUALIZER" button enables the equalizer. The equalizer is reset to "OFF" after each call.
- Equalization, and probably acoustic echo control, are accomplished using Digital Signal Processing functions. The **DSP** implementation does not allow sine wave signals to pass to the receiver. DTMF tones, clearly heard at the receiver in the unamplified mode, are reduced to chirps, clicks and pops when the equalizer is used. Testing requires the use of special voice-like test signals. A **pulsed pink** test signal, similar to that commonly used for speakerphone testing, was used when the equalizer was enabled.

SAMPLE "C"

- This telephone uses a slide potentiometer for the volume control.
- In addition there is a "Clarity" switch which, when activated, causes the receive signal to have a rising response starting around 300 Hz.

EVALUATION CRITERIA:

The following criteria were used to judge the tested units.

The telephones must pass the following requirements:

1. The telephones must have 20 dB gain delta between default volume and maximum volume.
2. The telephone must remain stable (no feedback or echo) when placed on a desk or brought near the face. A common test is to place the handset face down on a flat surface.
3. An external power supply is not allowed.
4. The Receive and Send Loudness (ROLR, TOLR) should be within the tolerances of TIA-470B.

The following are desirable features:

5. Receive Noise should meet telephone industry requirements at default volume.
6. The telephone should return to its unamplified state when returning on-hook so as not to hurt the ears of a normal-hearing person.

TEST RESULTS:

Using the criteria above, none of the telephones met requirements.

SAMPLE "A"

- The handset was unstable and "squealed" when placed face down on the desk.
- Requires an external AC supply.

SAMPLE "B"

- This telephone is stable (no "squealing").
- Did not quite meet the 20 dB criteria (is 18-19 dB).
- Is very noisy.
- Requires an external AC supply.
- Employs Special Circuitry that does not allow sine wave tones to pass when the volume control (equalizer) is active. This includes DTMF tones and dial tone. TDD and modem tones probably will not pass but this was not tested. Tones are received when the equalizer is turned off. See **Figure 11.**

SAMPLE "C"

- The handset "squeals" when placed face-down on a table. Sometimes it also squeals when bringing the handset near the ear. The owner's manual states: *" In addition, the high performance of this Clarity Power Control* **may** *cause the handset to "squeal" or produce feedback if the handset is set down on a* **hard** *surface during the course of* **a** *phone call. "*

- This sample was 6 dB quieter than a nominal telephone when the volume control was set in its minimum position. If this is typical of all units then the actual volume control range would be effectively be reduced by 6 dB compared to the other models tested. Althouah this telephone had the widest volume control range it was 4 to 5 dB quieter than the other telephones at the maximum position.

- The volume control does not reset between calls. The owners manual states: ***"Important:*** *Reset the Clarity Power Control to zero after every call to protect other users of the telephone"*

- This is the only telephone that does not require an external power supply.

Test results are summarized on the following page (Figure 1 and 2)

PARAMETER	SAMPLE "A"	SAMPLE "B"	SAMPLE "C"
At least 20 dB volume control?	YES	NO (18-19 dB)	YES (Note 1)
Stable at Maximum Volume?	NO	YES	NO
Works without External Power Supply?	NO	NO	YES
Meets Receive Loudness Requirement? (Set to minimum volume)	YES	YES	NO (6 dB quiet)
Meets Transmit Loudness Requirement? (TOLR)	YES	YES	YES
Meets Noise requirements at default?	NO	NO	YES
Volume Control Resets when placed back on-hook?	YES	YES	NO
Employs conventional circuitry?	?	NO (DSP)	?

Figure 1:
Comparison of Tested Units

Note 1. Sample "C" is 6 dB quieter than nominal at the minimum volume control.

PARAMETER	SAMPLE "A-	SAMPLE "B"	SAMPLE "C"
Noise at Minimum < 40 dB SPL (A)	41.4	46.7	31.0
Noise at Maximum (No Spec.) dB SPL (A)	64.1	69.1	56.6
Transmit Loudness (TOLR) -48 +8, -5 dB	-45.6	-46.6	-44.1
ROLR Loudness at Minimum +46 ± 5 dB	42.3	43.5	52.0
ROLR Loudness at Maximum dB	**22.9**	25.2	28.5
SPL Level at Minimum dB SPL (1 kHz)	**95.5**	**96.9**	87.7
SPL Level at Maximum dB SPL (1 kHz)	116.2	115.7	111.5
Volume Control Range Calculated using **ROLR** Proposed > 20 dB	19.4	**18.3**	23.5
Volume Control Range Calculated using **SPL** Proposed > 20 dB	20.7	18.6	23.9

Figure 2:
Summary of Measurements

Note: Since ROLR and TOLR are calculated using losses the more negative the ROLR or TOLR the louder the telephone.